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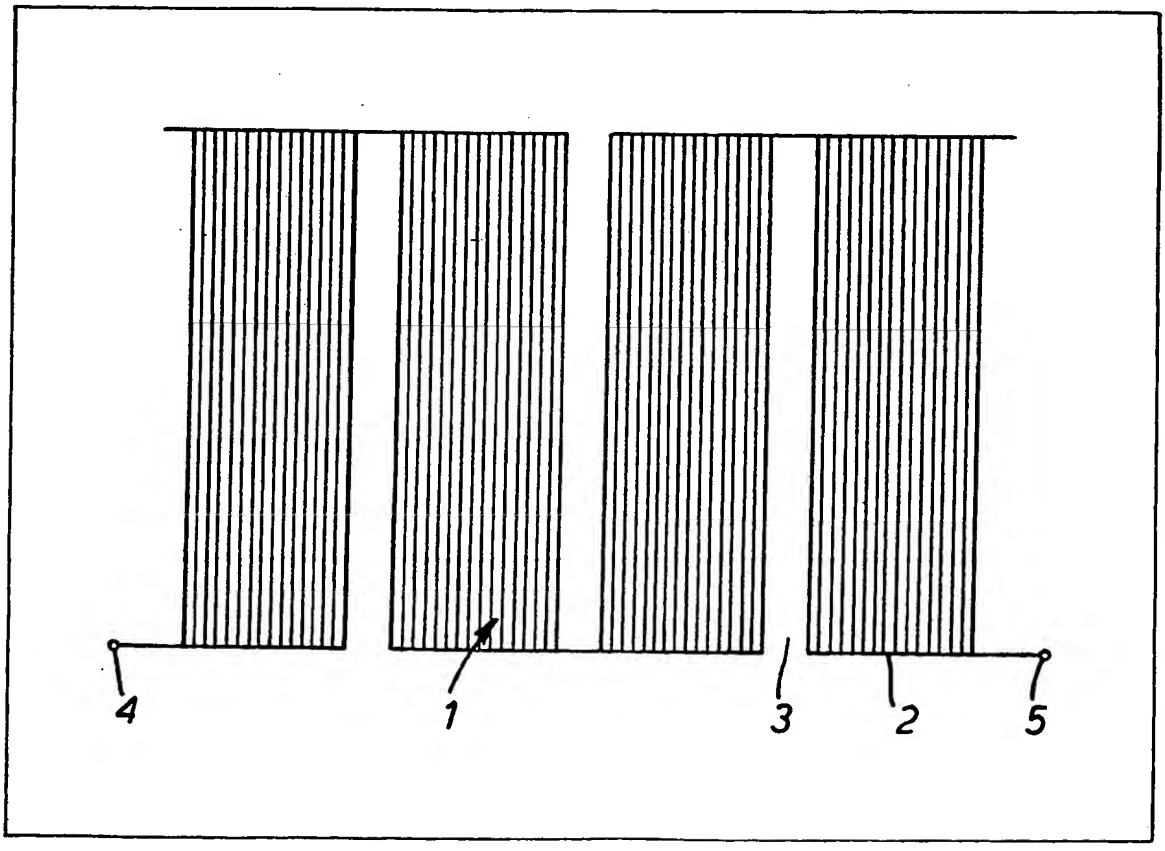
(54) **Heating fabric**

(57) A heating fabric contains heating wires (1) which are connected in parallel in both the selvedges by means of current wires (2), said heating wires being woven in strips or zones which are maintained at a distance from each other by woven yarns, and the heating wires in the strips or zones being wov n at a distance from each other which is not greater than $\pi/2$ (=1.57) times the wire diameter.



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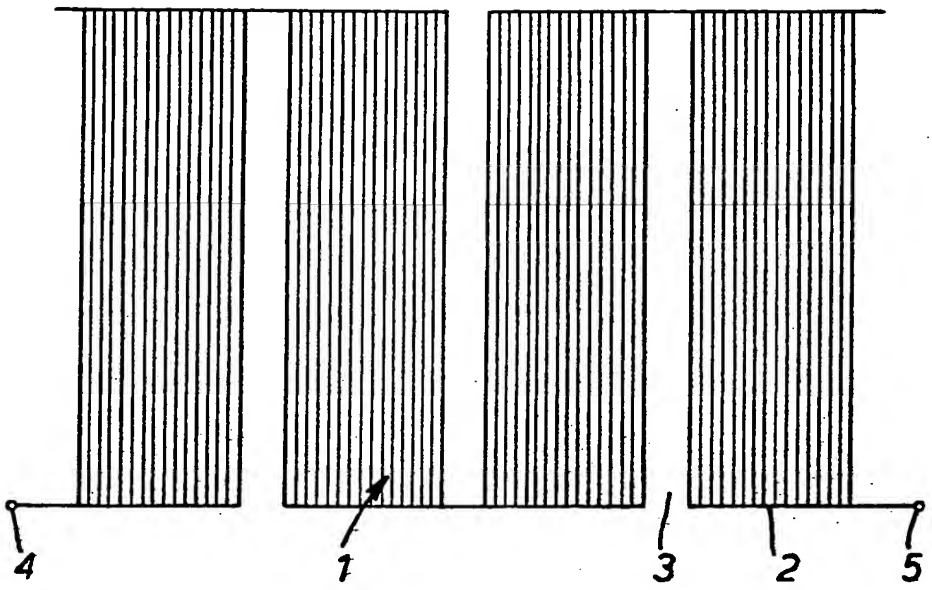

SPECIFICATION

Heating fabric

The invention relates to a heating fabric. One uses very high watt densities (q) of the order of 10,000 to 100,000 W/m^2 and higher whereby temperatures between 200° and 1000°C and higher are produced, at the usual electrical heating elements (as for example in toast-racks, iron-heaters and radiators). The contact conductor is provided here in heat resisting surroundings. However, if the contact conductor is woven in textiles (or incorporated therein as in the case of electric blankets) then such elevated temperatures are of course not allowable.

One has then to apply a considerably lower q of the order of magnitude from 100 to 400 W/m^2, as is usual and prescribed for electrical conductors in the house and industrial equipment.

Consequently the capacity of heating fabrics is limited to said watt densities.

It is usual on heating fabrics to indicate the wattage as well as the watt density in W/m^2 fabric surface.

This indicated watt density is equal to the wattage divided by the surface area of the fabric. One should think therefore to use a thermally safe fabric at an indicated low watt density.

However, since the wire surface is considerably smaller than the surface of the fabric (at either side) in practically all the cases, the generated watt density at the surface of the conductor is also considerably higher than the indicated value with the consequence that the wire temperature becomes considerably higher than should follow from the indicated watt density so that singeing damage and fire can be produced.

Since the watt density at the wire-surface is limited to the indicated values, the capacity of the fabric will have to be limited considerably in order to prevent fire risk.

However, it appears in the practice that one exceeds this limit with the indicated consequence.

If one should like to lower the thermal wire charge then on the other side the capacity fails. Only energy dissipation will be produced (consequently energy consumption without result) under these conditions by heating with this too low capacity.

A solution has not yet been given for this delicate problem hitherto.

The present invention is a heating fabric containing heating wires which are connected in parallel in both the selvedges by means of current wires, said heating wires being woven in strips or zones which are maintained at a distance from each other by woven yarns, the heating wires being spaced at a distance from each other which is not greater than $\pi/2$ (=1.57) times the wire diameter.

In this way the wire surface area has become equal to the surrounding fabric surface area.

Consequently the conclusion is that in this way the indicated watt density is equal to the watt density at the surface of the wire conductor.

One can go by this measure with the capacity to the given limit which is then also the same limit for each individual heating wire.

Consequently one can heat without danger and adequately with the fabric according to the invention to the allowable limit value which is equal to that of the individual wires.

The capacity of the fabric in the case of other fabrics is limited to the ratio wire surface/fabric surface; this ratio exceeds in most cases a factor 5

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawing, the single figure of which is a top view of a portion of the fabric according to the invention.

The heating wires 1 are grouped in strips interconnected by the current wires 2, the strips having spaces 3 therebetween. The reference numerals 4 and 5 indicate the connecting terminals.

Derivation 1.57 times the wire diameter

Considering now a strip of length B metres containing *a* parallel wires of diameter *d* mm

Total wire surface $F(dr) = (a.B.\pi.d)10^{-3} m^2$

A strip presents a total surface for both sides of $F(strip) = (a.\pi/2.d.10^{-3}).(B.2) = (a.B.\pi.d.10^{-3})\ (m^2)$

if one takes (π/2.d) for the distance between the wires.

Ergo : F(dr) = F(strip).

If the strips are woven at a small distance from each other, then the fabric surface is substantially equal to the common surface of the strips.

Consequently F(dr) = F(strip) = substantially F (fabric).

Calculation of q at the wire surface

Through the wire is generated:

$$Q = \frac{e^2}{r} \text{ (watt) or Q wh/h heat}$$

where e = voltage and r = ohmic resistance.

However, one can take for *e* the voltage per metre of wire length and for *r* the ohmic resistance per metre of wire length.

Consequently in this case:

Wire surface F(dr) = $\pi d.10^{-3}$ (m^2 per metre of wire length)

Ergo:

Watt density at the wire surface:

$$q = \frac{Q}{F(dr)} = \frac{e^2.10^3}{(r.\pi d)} \text{ W/m}^2$$

The invention has as an important result a great quantity of energy without an individual wire assuming a higher temperature than a strip or than the fabric.

CLAIMS

1. A heating fabric containing heating wires which are connected in parallel on both the sal-

The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

vedges by means of current wires, said heating wires being woven in strips or zones which are maintained at a distance from each other by woven yarns, the heating wires being spaced at a distance from each other which is not greater than $\pi/2$ (=1.57) times the wire diameter.

2. A heating fabric substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

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